DOCUMENT RESUME

ED 156 208 IR 006 441

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TITLE Computers and Calculators: A Strategy for Combined Usage in Trigonometry.
PUB DATE Jun 77
NOTE 12p.; Paper presented at the Conference on Computers in the Undergraduate Curricula (East Lansing, Michigan, June 20-22, 1977); For entire proceedings, see IR 006 142

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS Algorithms; Calculation; *College Mathematics; *Computer Assisted Instruction; Computer Programs; *Course Descriptions; Higher Education; Instructional Improvement; *Integrated Curriculum; Mathematics Instruction; Teaching Techniques; *Trigonometry; Undergraduate Study
IDENTIFIERS *Calculators (Hand); Cuyahoga Community College OH

ABSTRACT

The instructional strategy described was used to incorporate both the computer and the hand calculator into trigonometry courses at an Ohio community college. The computer was used to generate different problem sets for individual students and, at the same time, solution sets for the instructor. The students were required to use calculators to complete their individually assigned problem sets. Results achieved using this instructional strategy included increased student motivation, increased achievement with respect to objectives in trigonometry, and the acquisition of skills in the use of advanced personal hand calculators by the students. Two computer programs in BASIC for generating trigonometry problems are appended. (Author/CHV)

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COMPUTERS AND CALCULATORS: A STRATEGY FOR COMBINED USAGE IN TRIGONOMETRY

BY

Samuel W. Spero

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Computers and Calculators: A Strategy for Combined Usage in Trigonometry

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Introduction

One of the important uses of the computer in mathematics instruction at Cuyahoga Community College is for generating problem sets for students. A different collection of problems is prepared for each student. The students work on these problems either at home or in class. Depending on what the instructor has in mind these problem sets may be used for drill or for testing and evaluation. A crucial feature of this application of the computer is that at the same time that the computer generates the problem set for the student, it also generates the solution set for the instructor who is then able to evaluate each student individually.

In this article we will present the instructional strategy which we use in incorporating both the computer and the calculator into our trigonometry courses. The computer is used to generate problem sets for the students and solution sets for the instructor. The students are required to use calculators to complete their individually assigned problem sets. Among the results achieved by the use of this instructional strategy, we have found increased student motivation, increased achievement with respect to objectives in trigonometry, and the acquisition of considerable skill in the use of personal "scientific" calculators by the students.

College Trigonometry

The trigonometry course under discussion is the traditional course in which are enrolled students in engineering-oriented terminal vocational programs.

We were led to attempt our experiment with computer-generated problem sets as a result of an ongoing problem in mathematics instruction. That is the problem of evaluation. The usual approach to evaluation is to administer a single examination to the entire class during a regular class meeting. The difficulty in using this approach is that in areas of mathematics which are computationally-bound, the instructor must limit himself to the most trivial of problems so that the student can complete the examination within a single class meeting. This is especially true in a number of areas studied in trigonometry.

An alternative is to assign the students examinations which they work on at home. This approach is very appealing in that no class time is lost and the instructor can assign nontrivial problems. The difficulty associated with take-home examinations is that you cannot be sure that students will not work together.

Of course if each student is assigned a different problem or problem set on which to work, the difficulty is resolved—except for the instructor who now has to prepare many more problem and solution sets.

At this point it occurred to us that we might use the computer to generate both the problem and solution sets. Using the random number generator implicit in the BASIC computer language, it is not difficult to generate as many different problem sets as needed. We can even "personalize" each

problem set by adding the student's name. This feature also helps identify the relevant solution set when the problem sets are graded.

A further advantage presented itself almost immediately. If for one reason or another, a student is unable to take the test at the regularly scheduled time, there is no difficulty in preparing a "make-up" examination. In fact, if a student has difficulty in completing the particular problem set assigned to him, we will help him and then assign a new problem set. Since our ultimate objective is student learning this seems most reasonable.

At the outset of the experiment we were concerned whether our rather limited computer facility would be able to accommodate us. Our mathematics department owns a Data General Nova 1220 minicomputer with 16K words of core storage. There is no mass storage device attached to the computer, and the computer serves three terminals simultaneously. We use the BASIC computer language, and it is core resident. Thus our programs must be relatively short. Programs are saved on paper tapes which can be read into the computer at ten characters per second via the paper tape readers attached to each of the teletypes. As will be seen shortly the programs which generate the problem sets and their solutions are not long. We have not had any difficulty in accommodating them to our limited facility.

An objection that we anticipated from the students was that the non-trivial problems generated by the computer were much too tedious to solve by hand. So we decided to "let them eat cake."

For the past year or two we have noticed increasingly that the students enrolled in the trigonometry course own "scientific" calculators. In addition, we noticed that they do not know how to use them effectively. It seemed to us a waste not to have the students take advantage of this tool to help them learn more trigonometry, especially since they are always asking us if they can use their calculators on examinations, in preparing homework assignments, etc. If helping the students learn to use their calculators more efficiently helps them learn more trigonometry, and at the same time permits the instructors to use computer-generated problem sets, it seemed reasonable to integrate the calculator into the curriculum. This we have now done, which brings us to the topic of this article.

Computer Programs

Before describing two of the areas in which we have used the computer/calculator strategy, we will describe the strategy itself. In all of the cases to be described the material to be learned is first presented using the textbook for the course.[1] Students are encouraged to use their calculators throughout the course, but the exercises in the text itself do not demand calculator usage. The computer/calculator strategy begins at the conclusion of the unit being discussed. The strategy is basically a strategy for evaluation.

First a typical problem is generated by the computer. This we solve in class by way of review of the material discussed in that unit of study. This also provides the students with the opportunity to work out the problem-solving algorithms in terms of their own calculators. Several computer generated problems are then assigned to the entire class as a homework (non-credit) assignment. These are subsequently discussed during class and all questions concerning the solution of these problems are answered. Finally, each student is given his or her assignment to be completed at home. Each student is informed that if he has any difficulty completing the problem set he can get help and will be assigned another problem set. In all of these assignments we attempt to remove the threat of failure.

Angles, Their Measure and Their Trigonometric Functions: This is the very first unit in the course. Among the objectives in this unit are an understanding of the two ways in which we measure angles—degree and radian measure—and how to convert from one system to the other. In this unit the students also learn the definitions of the trigonometric functions and their interrelationships, as well as the concept of the inverse

trigonometric functions. We want students to understand the concept of a circular function and how a given angle, no matter how large, may be reduced to an angle less than 360°. Finally we want students to understand that any angle can be related to an angle in the first quadrant in terms of the absolute value of their respective trigonometric functions.

In order to evaluate students with respect to all of the objectives just described, we have the computer generate three types of problems. In problem-type I the computer generates a large angle measured in degrees. The student must convert that angle to radians. He must also relate the given angle to an angle less than 360° (which we call the related angle) and convert it to radians. He must then determine the reference angle which is the angle less than 90° that has the same trigonometric functions in absolute value. The reference angle must also be specified in both degrees and radians. Finally, for the given angle (or related angle) the student must specify all of the six trigonometric functions. Sample student output for this type of problem is included as Figure 1. Note the student's name in the output.

The type II problem is identical in all respects except that the angle given to the student is given to him in radian measure. A sample of the output for the student is included as Figure 2

Figure 1

```
PROBLEM FOR     SAM SPERO

GIVEN AN ANGLE OF                1790.78        DEGREES:

FILL IN THE MISSING VALUES:

ANGLE                            FUNCTIONS
GIVEN ANGLE
DEGREES          RADIANS         SIN            CSC

RELATED ANGLE
DEGREES          RADIANS         COS            SEC

REFERENCE ANGLE
DEGREES          RADIANS         TAN            COT
```

Figure 2

```
PROBLEM FOR     SAM SPERO

GIVEN AN ANGLE OF                32.0408        RADIANS:

FILL IN THE MISSING VALUES:

ANGLE                            FUNCTIONS
GIVEN ANGLE
DEGREES          RADIANS         SIN            CSC

RELATED ANGLE
DEGREES          RADIANS         COS            SEC

REFERENCE ANGLE
DEGREES          RADIANS         TAN            COT
```

Problem type III is a bit different. In this case the student is given two of the trigonometric functions of the angle. To simplify the computer program we have specified the two functions. These are the cosecant function and the tangent function. These two functions serve to uniquely define the angle. This angle will be less than 360° — what we call the related angle. Using the inverse trigonometric functions we want the student to determine the related angle, both in degrees and radians. We also want the student to determine the corresponding reference angle in degrees and radians. Finally, we want the student to determine the original angle generated by the computer which is equal to the related angle plus some multiple of 360 (in degree measure). To this end we give the student the value of the multiple of 360° which is needed to determine the given angle. This angle must also be determined both in degree and radian measure. A sample of the output for the student is included as Figure 3.

In each of the problem types the computer also generates for the instructor the student's name, the information given to the student, and the solution. For example the instructor's output for a type III problem would be as shown in Figure 4.

Figure 3

```
PROBLEM FOR     SAM SPERO

GIVEN THE COSECANT FUNCTION =   1.00829
      THE TANGENT FUNCTION =    7.7516
      THE GIVEN ANGLE = THE RELATED ANGLE +   18   X 360:

FILL IN THE MISSING VALUES:

ANGLE                                   FUNCTIONS
GIVEN ANGLE
DEGREES          RADIANS                SIN                CSC

RELATED ANGLE
DEGREES          RADIANS                COS                SEC

REFERENCE ANGLE
DEGREES          RADIANS                TAN                COT
```

Figure 4

```
SOLUTION FOR    SAM SPERO
GIVEN THE COSECANT FUNCTION =   1.00829
      THE TANGENT FUNCTION =    7.7516
      THE GIVEN ANGLE = THE RELATED ANGLE +   18   X 360:

ANGLE                                   FUNCTIONS
GIVEN ANGLE
DEGREES          RADIANS                SIN                CSC
 1522.65          26.5752                .991781            1.00829

RELATED ANGLE
DEGREES          RADIANS                COS                SEC
 82.6504          1.44252                .127945            7.81584

REFERENCE ANGLE
DEGREES          RADIANS                TAN                COT
 82.6492          1.4425                 7.7516             .129006
```

As can be seen, the role of the calculator in these exercises is considerable. In problem types I and II the students must first use their calculators to convert from radian measure to degree measure or vice versa. Depending on the type of calculator they own this may involve arithmetic, or it may involve no more than pressing a single key. What is crucial is that the student master his own calculator. Next he must be able to reduce the given angle to a related angle and then to a reference angle. This involves straightforward, but tedious, application of principles studied in the unit. The calculator allows this aspect of the problem to be completed quickly. The student must recognize the trigonometric function keys on his calculator and how to use them to determine the sine, cosine, and tangent functions. He must also recognize the importance of the reciprocal key which he uses to determine the cosecant, secant, and cotangent functions.

In problem type III the student must use the inverse trigonometric function keys. He must also understand the material studied, because the inverse function keys return only an angle between -90° and $+90^\circ$. This represents the reference angle. The student must perform an analysis on the two given functions to determine in which quadrant the related angle lies. Then using the calculator and the reference angle the student can determine first the related angle and finally the given angle.

As described above, we first solve each of the problem types in class, using calculators. Then several are assigned for homework from each of the problem types. Finally each student is given one of each problem type for evaluation purposes.

The computer program for the above is included as Appendix 1.

Applications of the Trigonometric Functions—the Triangle Problem

The classical application of the trigonometric functions which all students study is the use of the law of sines and the law of cosines in the analysis of the parts of a triangle and in the calculation of its area. The objectives in this unit of study include the definitions of the trigonometric functions in terms of a triangle, the law of sines, and the law of cosines. A number of theorems from elementary geometry are also crucial to this unit. These include the Pythagorean Theorem and the theorem which states that the sum of the angles of a triangle must be 180°. In addition the students must learn to analyze which of four possible cases has been presented to them, and then determine the appropriate problem-solving algorithm.

In the triangle problem the students must determine all six parts of a triangle. These include the three angles and the three associated sides. In the problems given to the students they are presented with three of the six parts. Using the theorems and the trigonometric laws they have learned, they have sufficient information to analyze the triangle completely. The four cases are as follows:

1. Given: three sides.
2. Given: two sides and the included angle.
3. Given: two sides and the angle opposite one of them.
4. Given: two angles and one side.

Once the students have determined all of the parts of the triangle, the students determine the area using the known parts of the triangle.

In the course of the discussion of this unit, the students learn to apply the law of sines and the law of cosines using their calculators. Each student develops in his notes the appropriate button-pushing sequence required for his own calculator. Thus by the end of the unit, the students have developed all of the tools they require to solve the given problems quickly once they have performed the appropriate analysis.

In class we present examples of the problem types which might be encountered. Similarly, for homework the students receive examples of all types for practice. In the evaluation exercise, however, the students receive several problems which are randomly generated. They may be the same type or entirely different. The analysis is a major aspect of the evaluation.

Figure 5 is a sample of the output from the computer. It includes both the student output and the instructor output. The instructor must, of course, separate the two sections. this approach was necessary from the point of view of saving time in the production of the problems, since we were limited to the output from a ten-character-per-second teletype. It also permitted us to use a much simpler programming procedure which was more conducive to the limitations of our hardware.

```
SOLVING TRIANGLES


          *
        *   *
      *   Z   *
    A*           *B
    *             *
  *   Y         X   *
**********************
          C


ANGLE OPPOSITE SIDE  A  IS ANGLE  X
ANGLE OPPOSITE SIDE  B  IS ANGLE  Y
ANGLE OPPOSITE SIDE  C  IS ANGLE  Z


STUDENT NAME -- SAM SPERO

PROBLEM  1
GIVEN:  ANGLE X=   3.63262
        ANGLE Y=   45.2274
        SIDE  C=   92.9515
SOLVE THE TRIANGLE
        ANGLE Z=
        SIDE  A=
        SIDE  B=

THE AREA IS


PROBLEM  2
GIVEN:  ANGLE Z=   28.67
        SIDE  A=   37.71
        SIDE  B=   80.01
SOLVE THE TRIANGLE
        ANGLE X=
        ANGLE Y=
        SIDE  C=

THE AREA IS


STUDENT NAME -- SAM SPERO

PROBLEM  1 --TYPE  1
GIVEN:  ANGLE X=   3.63262
        ANGLE Y=   45.2274
        SIDE  C=   92.9515

        ANGLE Z=   131.14
        SIDE  A=   7.82
        SIDE  B=   87.62

THE AREA IS  258.01


PROBLEM  2 --TYPE  2
GIVEN:  ANGLE Z=   28.67
        SIDE  A=   37.71
        SIDE  B=   80.01

        ANGLE X=   21.0848
        ANGLE Y=   130.245
        SIDE  C=   50.2903

THE AREA IS  723.766
```

```
PROBLEM  3
GIVEN:  ANGLE Y=   28.5179
        SIDE  B=   37.84
        SIDE  A=   44.15
SOLVE THE TRIANGLE
        ANGLE X=
        ANGLE Z=
        SIDE  C=

THE AREA IS
```

```
PROBLEM  3 --TYPE  3
GIVEN:  ANGLE Y=   28.5179
        SIDE  B=   37.84
        SIDE  A=   44.15

        ANGLE X=   33.8521
        ANGLE Z=   117.63
        SIDE  C=   70.2185

THE AREA IS  740.06
```

```
PROBLEM  4
GIVEN:  SIDE  A=   63.18
        SIDE  B=   95.43
        SIDE  C=   95.7639
SOLVE THE TRIANGLE
        ANGLE X=
        ANGLE Y=
        ANGLE Z=

THE AREA IS
```

```
PROBLEM  4 --TYPE  4
GIVEN:  SIDE  A=   63.18
        SIDE  B=   95.43
        SIDE  C=   95.7639

        ANGLE X=   38.5917
        ANGLE Y=   70.4183
        ANGLE Z=   70.99

THE AREA IS  2850.22
```

Figure 5

The computer program for the above is included as Appendix II.

Other areas in the trigonometry course where we use this approach are in graphing the sine and cosine functions for arbitrary amplitude, frequency and phase angle and in multiplying, dividing, and exponentiating complex numbers. Those interested may obtain the computer programs and sample output from the author.

Summary and Conclusions

The instructional strategy we have presented in this article—which includes the use of the computer to generate problem sets for students and solution sets for teachers as well as extensive student use of calculators to solve the problem sets—has had a number of ramifications beyond the original intent.

The original intent of this approach was to permit more effective evaluation of student learning. While we have not tested this approach formally (a research project is presently underway); intuitively we feel that the approach does provide more effective evaluation. Not only are we able to provide students with their own individual problem sets which they can work at home, but also we have been better able to crystalize our objectives for the students. By being able to focus directly on the learning objectives in instruction, the students are more aware of what is expected of them. This leads to improved learning.

In addition, encouraging students to use their calculators has increased student motivation considerably. Students spend time developing effective algorithms for solving problems with their calculators. As a result they have learned more trigonometry. Thus we have not only developed a tool for evaluation, but we have been able as a result to motivate our students and to help them learn more.

In using the computer to generate problem sets for students and solution sets for the teacher, we feel that we have touched upon an approach which places the computer in a role for which it is unquestionably well-suited. In this role it provides the instructor with technological assistance in completing a task which he could not reasonably perform him-

self. To provide this assistance we require only a minimal computer facility which makes the computer's assistance cost effective. The instructor, on the other hand, reaps maximum benefit. Using the computer in this way we have been able to motivate the student; we have been able to help him learn concepts more effectively, and we have been able to evaluate the effectiveness of the entire process. What more can we ask of computer-assisted-instruction?

Note

1. I. Drooyan, W. Hadel, C. Carico, *Essentials of Trigonometry*, MacMillan Publishing Co., N.Y., 1971.

Appendix 1

Program for: Angles: Their Measure and Their Trigonometric Functions

```
100 READ S$
110 DATA "SAM SPERO"
120 PRINT"PROBLEM FOR  ",S$
130 PRINT
140 PRINT
150 LET D=RND(-1)*100
160 LET S=SIN(D)
170 LET C=COS(D)
180 LET T=S/C
190 LET S1=1/S
200 LET C1=1/C
210 LET T1=1/T
220 LET D1=D*180/3.14159
230 LET M=INT(D/6.28318)
240 LET D2=D-M*6.28318
250 LET D4=ABS(ATN(T))
260 LET D3=D2*180/3.14159
270 LET D5=D4*180/3.14159
280 LET N=INT((D+.005)/D2)
290 LET B=INT(RND(-1)*3)+1
300
310 ON B GOTO 340,420,500
320 PRINT"SOLUTION FOR",S$
330 ON B GOTO 380, 460, 560
340 PRINT"GIVEN AN ANGLE OF",D1,"DEGREES:"
350 PRINT
360 GOSUB 620
370 GOTO 320
380 PRINT"GIVEN AN ANGLE OF", D1,"DEGREES:"
390 PRINT
400 GOSUB 770
410 GOTO 940
420 PRINT"GIVEN AN ANGLE OF",D,"RADIANS:"
430 PRINT
440 GOSUB 620
450 GOTO 320
460 PRINT "GIVEN AN ANGLE OF",D,"RADIANS"
470 PRINT
480 GOSUB 770
490 GOTO 940
500 PRINT"GIVEN THE COSECANT FUNCTION =",S1
510 PRINT TAB(6);"THE TANGENT FUNCTION =",T
520 PRINT TAB(6);"THE GIVEN ANGLE = THE RELATED ANGLE + ";M;" X 360:"
530 PRINT
540 GOSUB 620
550 GOTO 320
560 PRINT"GIVEN THE COSECANT FUNCTION =",S1
570 PRINT TAB(6);"THE TANGENT FUNCTION =",T
```

```
580 PRINT TAB(6);"THE GIVEN ANGLE = THE RELATED ANGLE + ";M;" X 360:"
590 PRINT
600 GOSUB 770
610 GOTO 940
620 PRINT"FILL IN THE MISSING VALUES:"
630 PRINT
640 PRINT"ANGLE",,"FUNCTIONS"
650 PRINT"GIVEN ANGLE"
660 PRINT"DEGREES","RADIANS","SIN","CSC"
670 PRINT
680 PRINT"RELATED ANGLE"
690 PRINT"DEGREES","RADIANS","COS","SEC"
700 PRINT
710 PRINT"REFERENCE ANGLE"
720 PRINT"DEGREES","RADIANS","TAN","COT"
730 PRINT
740 PRINT
750 PRINT"------------------------------------------------------------"
760 RETURN
770 PRINT
780 PRINT
790 PRINT"ANGLE",,"FUNCTIONS"
800 PRINT"GIVEN ANGLE"
810 PRINT"DEGREES","RADIANS","SIN","CSC"
820 PRINT D1,D,S,S1
830 PRINT
840 PRINT"RELATED ANGLE"
850 PRINT"DEGREES","RADIANS","COS","SEC"
860 PRINT D3,D2,C,C1
870 PRINT
880 PRINT"REFERENCE ANGLE"
890 PRINT"DEGREES","RADIANS","TAN","COT"
900 PRINT D5,D4,T,T1
910 PRINT
920 PRINT
930 RETURN
940 END
```

Appendix 2

Program for: Applications of the Trigonometric Functions—the Triangle

```
100 PRINT
110 PRINT "SOLVING TRIANGLES"
120 PRINT
130 PRINT
140 PRINT  TAB(8);"*"
150 PRINT  TAB(7);"* *"
160 PRINT  TAB(6);"* Z *"
170 PRINT  TAB(4);"A*      *B"
180 PRINT  TAB(4)"*        *"
190 PRINT  TAB(3);"* Y      X *"
200 PRINT  TAB(2);"*************"
210 PRINT  TAB(7);"C"
220 PRINT
230 PRINT "ANGLE OPPOSITE SIDE  A  IS ANGLE  X"
240 PRINT "ANGLE OPPOSITE SIDE  B  IS ANGLE  Y"
250 PRINT "ANGLE OPPOSITE SIDE  C  IS ANGLE  Z"
260 PRINT
270 PRINT
280 READ N$
290 DATA "SAM SPERO"
```

```
300 PRINT "STUDENT NAME -- ";N$; TAB(40);"STUDENT NAME -- ";N$
310 LET B=0
320 FOR J= 1 TO 4
330 FOR I= 4 TO 5
340 LET A(I)=INT(RND(-1)*10000)/100
350 IF A(I)<1 THEN 340
360 NEXT I
370 LET A(3)=INT(RND(-1)*16000)/100
380 IF A(3)<10 THEN 370
390 LET T1=A(3)*3.14159/180
400 LET A(6)=SQR(A(4)↑2+A(5)↑2-2*A(4)*A(5)*COS(T1))
410 LET T2=(A(5)↑2+A(6)↑2-A(4)↑2)/(2*A(5)*A(6))
420 LET T2=SQR(1-T2↑2)/T2
430 IF T2>=0 THEN 460
440 LET A(1)=180-ABS(ATN(T2))*180/3.14159
450 GOTO 470
460 LET A(1)=ATN(T2)*180/3.14159
470LET A(2)=180 -A(1)-A(3)
480 LET B=B+1
490 PRINT
500 PRINT
510 PRINT"PROBLEM ";J;TAB(40);"PROBLEM ";J;"--TYPE ";B
520  ON B GOTO 530, 610, 690, 770
530 PRINT"GIVEN: ANGLE X= ";A(1);TAB(40);"GIVEN: ANGLE X= ";A(1)
540 PRINT TAB(7);"ANGLE Y= ";A(2);TAB(40);TAB(47);"ANGLE Y= ";A(2)
550 PRINT TAB(7);"SIDE  C= ";A(6);TAB(47);"SIDE  C= ";A(6)
560 PRINT"SOLVE THE TRIANGLE"
570 PRINT TAB(7);"ANGLE Z= ";TAB(47);"ANGLE Z= ";A(3)
580 PRINT TAB(7);"SIDE  A= ";TAB(47);"SIDE  A= ";A(4)
590 PRINT TAB(7);"SIDE  B= ";TAB(47);"SIDE  B= ";A(5)
600 GOTO 850
610 PRINT"GIVEN: ANGLE Z= ";A(3);TAB(40);"GIVEN: ANGLE Z= ";A(3)
620 PRINT TAB(7);"SIDE  A= ";A(4);TAB(47);"SIDE  A= ";A(4)
630 PRINT TAB(7);"SIDE  B= ";A(5);TAB(47);"SIDE  B= ";A(5)
640 PRINT"SOLVE THE TRIANGLE"
650 PRINT TAB(7);"ANGLE X= ";TAB(47);"ANGLE X= ";A(1)
660  PRINTTAB(7);"ANGLE Y= ";TAB(47);"ANGLE Y= ";A(2)
670 PRINT TAB(7);"SIDE  C= ";TAB(47);"SIDE  C= ";A(6)
680  GOTO 850
690 PRINT"GIVEN: ANGLE Y= ";A(2);TAB(40);"GIVEN; ANGLE Y= ";A(2)
700 PRINT TAB(7);"SIDE  B= ";A(5);TAB(47);"SIDE  B= ";A(5)
710 PRINT TAB(7);"SIDE  A= ";A(4);TAB(47);"SIDE  A= ";A(4)
720 PRINT"SOLVE THE TRIANGLE"
730 PRINT TAB(7);"ANGLE X= ";TAB(47);"ANGLE X= ";A(1)
740 PRINT TAB(7);"ANGLE Z= ";TAB(47);"ANGLE Z= ";A(3)
750 PRINT TAB(7);"SIDE  C= ";TAB(47);"SIDE  C= ";A(6)
760 GOTO 850
770 PRINT"GIVEN: SIDE  A= ";A(4);TAB(40);"GIVEN: SIDE  A= ";A(4)
780 PRINT TAB(7);"SIDE  B= ";A(5);TAB(47);"SIDE  B= ";A(5)
790 PRINT TAB(7);"SIDE  C= ";A(6);TAB(47);"SIDE  C= ";A(6)
800 PRINT"SOLVE THE TRIANGLE"
810 PRINT TAB(7);"ANGLE X= ";TAB(47);"ANGLE X= ";A(1)
820 PRINT TAB(7);"ANGLE Y= ";TAB(47);"ANGLE Y= ";A(2)
830 PRINT TAB(7);"ANGLE Z= ";TAB(47);"ANGLE Z= ";A(3)
840 GOTO 850
850 PRINT
860 LET T3=.5*A(5)*A(6)*SIN(A(1)*3.14159/180)
870 PRINT"THE AREA IS";TAB(40);"THE AREA IS ";T3
880 NEXT J
890 END
```